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David K. Aylward

EX PARTE OF LITE FILED

September 16, 1997

William F. Caton  
Acting Secretary  
Federal Communications Commission  
Room 200  
1919 M Street, N.W.  
Washington, DC 20554

RECEIVED

SEP 17 1997

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

Re: Notice of Ex Parte Communication  
CC Docket Number 94-102

Dear Mr. Caton:

Yesterday representatives of TruePosition, Inc. including Kent Sander, President and COO of TruePosition, Claudia James of Podesta Associates, and myself met with Jackie Chorney, Acting Senior Legal Advisor to the Honorable Chairman Reed Hundt. TruePosition, Inc. is a subsidiary of The Associated Group and is located in Bala Cynwyd, Pennsylvania. The purpose of the meeting was to brief Ms. Chorney on the successful developments of Phase II wireless location technology and share the results of a recent E9-1-1 consumer survey.

We discussed the results of TruePosition's successful live New Jersey Phase II trial which took place in May of this year and the implications they have for the Report and Order and Further Notice of Proposed Rulemaking. A copy of this report that was released by the New Jersey Attorney General, *The First 100 Days*, is attached for the record. In addition, we shared the results of Public Opinion Strategies' recent "Wireless Enhanced 9-1-1 Survey" which sought the opinions of 800 wireless subscribers and those who had considered subscribing in the past year.

In compliance with the Commission's rules, I have attached two copies of these documents for the record. If you have any questions regarding this correspondence or submitted materials, please contact me at your convenience.

Very Truly Yours,



David K. Aylward

CC: Ms. Jackie Chorney

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## WIRELESS ENHANCED 911 SURVEY FINDINGS

### Methodology

*Public Opinion Strategies recently completed a national poll of 800 wireless telephone users or people who considered buying a wireless telephone in the past year. The poll was completed on July 31-August 3, 1997, and has a margin of error of  $\pm 3.46\%$ , in 95 out of 100 cases. This means that if this survey were replicated, the results would be within about three percentage points 95% of the time. Seventy percent of the respondents were people who are current subscribers, while 30% were individuals who over the past year have considered buying a wireless phone.*

### Summary

This survey clearly shows that offering enhanced 911 location technology would be an attractive marketing offering for carriers. It fits in perfectly with the rationale why most people buy wireless phones — safety. The importance of the technology is increased even more among the majority who didn't know 911 operators can't locate wireless callers. Respondents rank location technology as the most important service to them personally and they want it mandatory by 2001 at the latest.

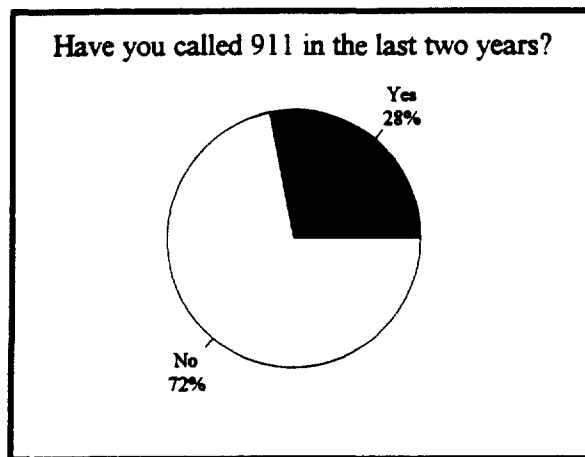
People are also willing to pay for location technology, at a cost significantly higher than that which would probably be charged. Furthermore, a significant number of non-subscribers say the technology would increase the likelihood they would subscribe and majority of current subscribers say they would consider switching from a company which did not offer the technology to one that did.

### Key Findings

Key findings from the survey include:

1. *People buy wireless phones for safety.*

Confirming what many other surveys have found, wireless phone users purchase their phones primarily for safety. Overall, 28% said they called 911 in the past two years.

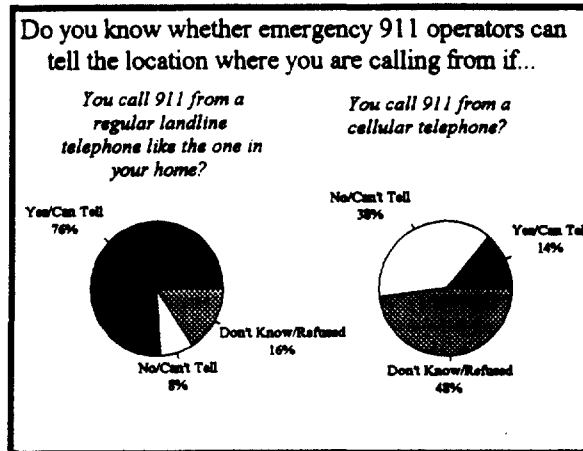


Asked which is more important to them, the additional safety and security that wireless phones offer or business convenience, 79% said the additional safety and security was more important, while 17% chose business convenience.

Given a list of five possible reasons to buy a wireless phone and asked which was the best reason to own one, 40% picked car problems on the highway, followed by medical emergencies (23%). Seventeen percent chose keeping in touch with their families, with 13% giving business reasons.

2. ***Most wireless subscribers do not know whether emergency dispatchers can tell where they are calling from.***

The vast majority of those surveyed (76%) were aware that 911 operators can tell the location where they are calling from if they are calling from a regular landline telephone. However, only 38% answered correctly that 911 operators **cannot** tell the location they are calling from if they are using a wireless telephone; 14% thought 911 operators can tell where wireless calls are coming from, while 48% of those polled did not know if 911 operators could locate wireless calls or not.

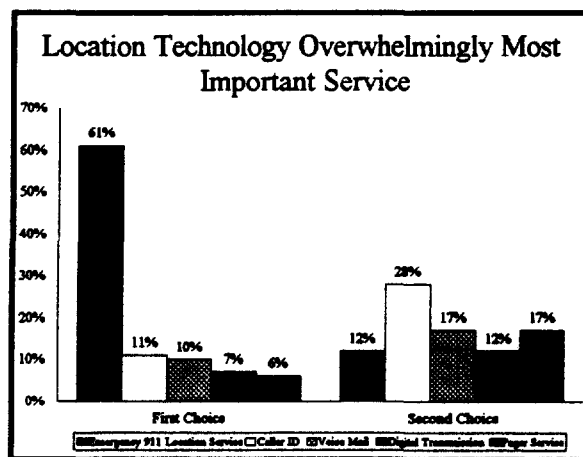


3. ***Wireless subscribers think enhanced 911 location technology is a very important service.***

Sixty-four percent of those interviewed said 911 location technology would be a **very** important service for wireless telephone companies to offer. Only 26% thought it was somewhat important, and just eight percent said it was not at all important.

Location technology is even more important to respondents who are considering buying a wireless telephone (74% very important) and among those who incorrectly assumed 911 dispatchers could locate wireless callers (73%).

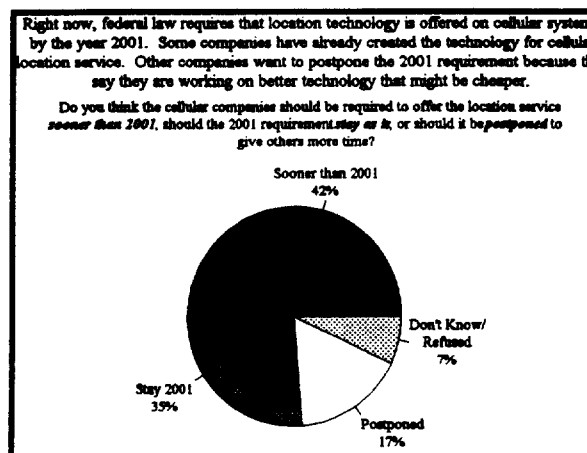
Given a list of five possible services, 61% said emergency 911 location service would be the most important service to them personally, with eleven percent choosing caller ID, ten percent voice mail, seven percent digital transmission and six percent pager service.



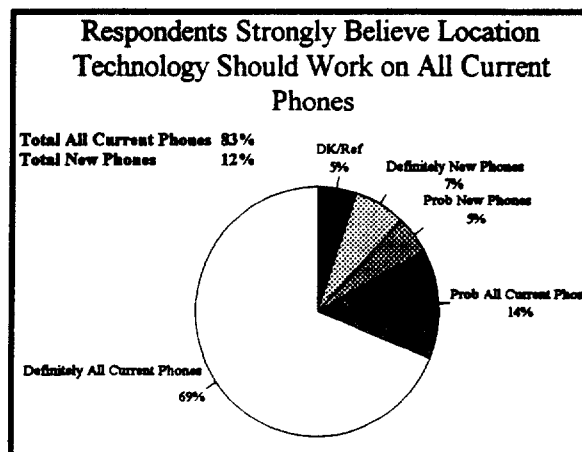
4. ***Wireless subscribers support the FCC's order and want emergency 911 location technology no later than 2001.***

After an explanation of the federal requirement that location technology be offered by wireless systems by 2001, respondents were asked whether they think companies should be required to offer the service sooner than 2001, whether the deadline should stay the same, or whether it should be postponed to give other companies time to develop better technology.

Forty-two percent think companies should be required to offer the service sooner than 2001, while 35% think it should stay 2001. Only 17% think the requirement should be postponed.

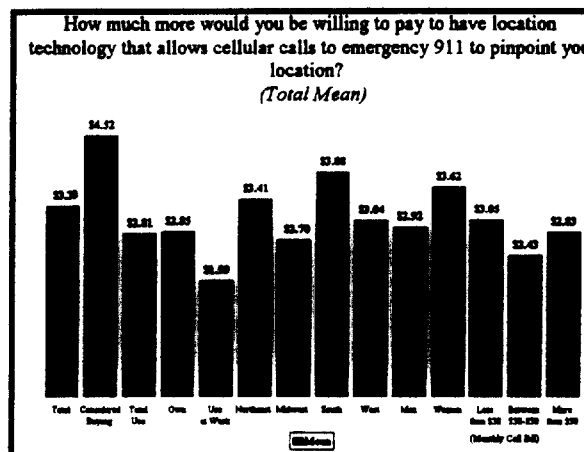


In addition, 83% say location technology should serve all current wireless phones, while just 12% think it should apply only to new phones. Respondents feel strongly about having it apply to all current phones, with 69% saying the technology should definitely apply to all current phones.



5. *And consumers are willing to pay for it.*

Asked in an open-ended question how much they would be willing to pay each month for enhanced 911 location technology service, the average amount respondents said was \$3.30. In a subsequent question, seventy-one percent also said they think \$1.50 is a “fair price” to pay for the service.

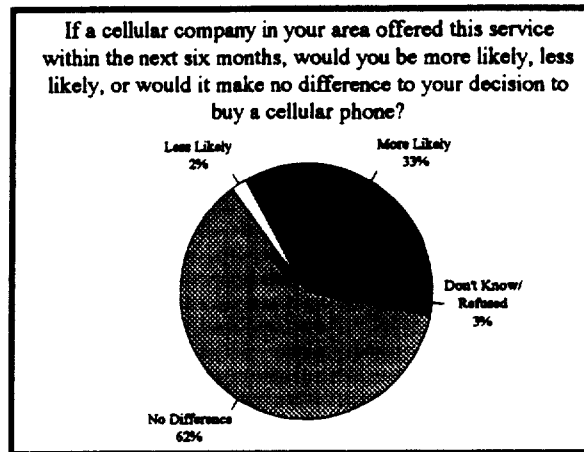


Fifty-five percent think the additional amount they would have to pay for the government-required location technology is a safety fee, while 27% view it as a value-added service. Only 13% think it is a tax increase.

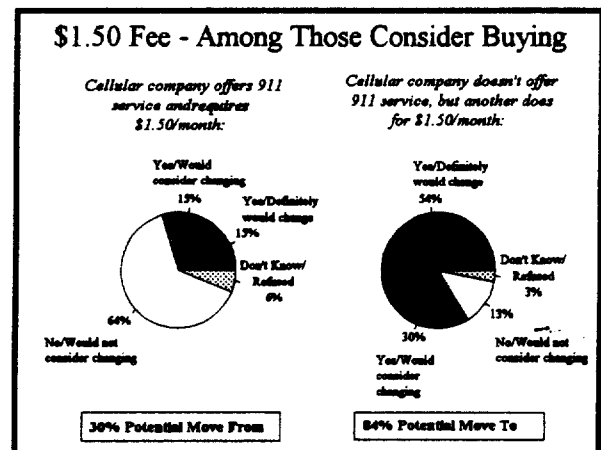
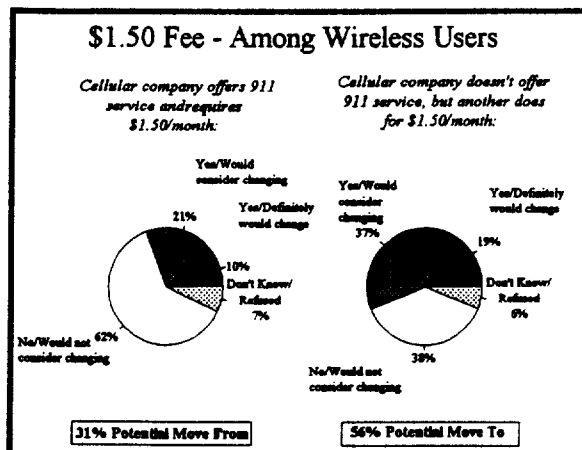
6. *Wireless 911 location technology increases the likelihood non-users will become subscribers. A large number of subscribers would switch to a carrier who offers the service from one that does not.*

A third of respondents who considered buying a wireless phone in the past year said they would be more likely to buy a wireless phone in the next six months if the location service was offered by a carrier in their area.

Wireless Enhanced 911 Survey — Key Findings  
 September 8, 1997  
 page 6

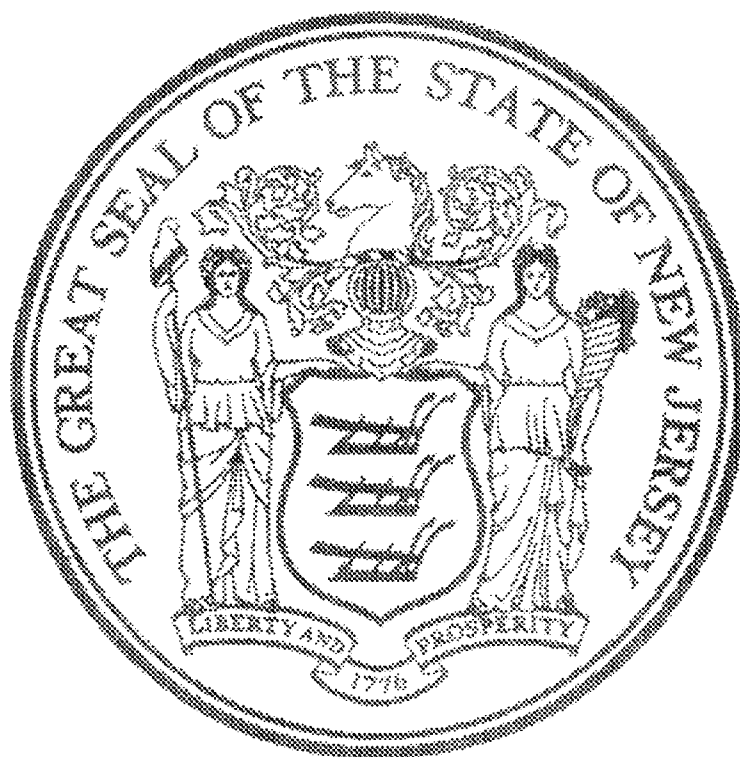


In addition, a majority of current subscribers (56%) said they would consider changing carriers if their carrier did not offer the service and another carrier was offering it for about \$1.50 a month. Nineteen percent said they would definitely switch, while 37% said they would consider changing.



**Report On The New Jersey  
Wireless Enhanced 9-1-1 System Trial  
January 22 to April 30, 1997**

***The First 100 Days***



**State of New Jersey  
Department of Law and Public Safety  
Division of State Police  
Colonel Carl A. Williams, Superintendent  
Office of Emergency Telecommunications Services  
S. Robert Miller, Executive Director**

**Christine Todd Whitman  
Governor**

**Peter Verniero  
Attorney General**

**June 16, 1997**





## State of New Jersey

DEPARTMENT OF LAW AND PUBLIC SAFETY  
OFFICE OF THE ATTORNEY GENERAL

CHRISTINE TODD WHITMAN  
*Governor*

CN 080  
TRENTON, NJ 08625-0080  
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PETER VERNIERO  
*Attorney General*

June 16, 1997

I am pleased to release the report entitled "The First 100 Days", detailing the results of New Jersey's first in-the-nation live trial of Wireless Enhanced 9-1-1 technology. This trial had an immediate impact on improving public safety. The findings from the trial represent significant progress in our efforts to quickly locate emergencies after a wireless caller dials 9-1-1. They prove that the commercial technology exists and can be deployed to meet the Federal Communications Commission's Wireless E9-1-1 Report and Order in Docket No. 94-102.

The State of New Jersey took the lead in conducting the nation's first live trial utilizing wireless location technology. The cooperation between the State of New Jersey, county governments, emergency personnel, and the private sector demonstrated a partnership model that can be replicated to provide enhanced wireless 9-1-1 service across the State and throughout the country.

Over an area of 350 square miles in southern New Jersey, where the location technology was deployed, our Public Safety Answering Points (PSAPs) were quickly able to pinpoint the location of over 3,500 wireless callers. Dispatchers had to stay on the phones for far less time with each individual caller, and even callers with no recognizable landmarks in sight were easily and quickly located. This meant that multiple dispatch units did not need to be sent to callers who could not describe their location, and accidents which received many calls from passing motorists could be easily identified as one incident. Most important, response units were able to arrive at emergency scenes much more quickly to aid victims. Overall, this new system was extremely efficient in helping 9-1-1 callers.

We hope that the findings and recommendations in this report will help expedite the full and rapid deployment of wireless E9-1-1 location technology. With more than 46 million wireless subscribers in the U.S. and 60,000 wireless calls to 9-1-1 being made each day, and both increasing rapidly, the need for a nationwide wireless 9-1-1 location system grows every day.

Sincerely yours,

A handwritten signature in cursive script that reads "Peter Verniero".

Peter Verniero  
Attorney General

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***Mission Statement of the New Jersey  
Office of Emergency Telecommunications Services (OETS)***

The New Jersey Office of Emergency Telecommunications Services (OETS), in consultation with the telephone companies and the Board of Public Utilities and with the assistance of the Office of Telecommunications and Information Systems in the Department of Treasury, has the responsibility to plan, design, coordinate and implement the statewide 9-1-1 (enhanced) telephone system.

## Executive Summary

**Background** Wireless calls to E9-1-1 Public Safety Answering Points (PSAPs) have significantly improved public safety. However, because of call volume and the time it can take for emergency personnel to determine the location of the caller, they have created new challenges. Unlike wireline calls to E9-1-1, there is no information, such as a callback number or the caller's location, available to E9-1-1 operators for answering wireless calls. Frequently, wireless callers do not know their exact location, especially at night when surroundings are unfamiliar and the trauma of an accident or other emergency reduces cognizance. Therefore, in July, 1996, the FCC issued a Report and Order designed to address these problems. FCC Phase I provides for callback number and originating cell site to be reported to E9-1-1 operators. Phase II provides for the callback number and the caller's location (generally within 410 feet).

**Launch** On January 22, 1997, only 6 months after the FCC Report and Order, the New Jersey Office of Emergency Telecommunications Services (OETS) launched the first live wireless enhanced 9-1-1 trial in the United States. The trial, using the Comcast Cellular Communications system, covered a 50 mile corridor of the New Jersey Turnpike and I-295 through Salem, Gloucester, Camden, and Burlington counties, and employed new and developing technology from a number of companies including: TruePosition, SCC Communications, Rockwell Telecommunications, KML Technologies, and others. The trial focused on the most popular type of wireless telephone in the country - cellular AMPS-based telephones.

**Objectives** The primary objective of the New Jersey Wireless Enhanced 9-1-1 System trial was to determine whether commercial technology exists today to meet New Jersey's wireless 9-1-1 requirements and those of the FCC Report and Order. Since the technology was literally brand-new and developing, OETS also wanted to determine (i) whether changes would be required to move from technology trial to full operational systems, (ii) what technical system integration challenges must be faced, (iii) whether the trial would have any impact on the existing New Jersey 9-1-1 network, and (iv) whether E9-1-1 operators would see significant value in having technology like this at their disposal.

**Results** Based on testing conducted from January 22 to April 30, 1997, OETS has concluded that the system trial was extremely successful in demonstrating that commercial technology exists to meet the needs of the FCC's Phase I and Phase II in New Jersey and elsewhere. This conclusion is based upon over 3,500 live wireless 9-1-1 calls received, and over 81,000 test calls placed by participants in the trial. The wireless 9-1-1 location system was demonstrated on multiple days at multiple test points on calls by multiple independent test participants and proves its ability to meet the FCC Phase II requirement of 410 feet, 67% criteria. OETS also concluded the system was extremely valuable to E9-1-1 operators, and that the impact on the existing network was minimal. Most importantly, OETS concluded that its everyday use made emergency response so routine that sensational 'search and rescues' like that involving a woman stuck in the snow for 40 hours in South Dakota never happened. The testing also identified changes required when upgrading from technology trial to full state-wide operations. For example, test points achieving the 410 feet requirement were in areas of good location system coverage. The overall system average was approximately 600 feet, but this can be lowered to or below 410 feet by upgrading the system coverage to the level used in the successful areas.

## **I. Wireless E9-1-1 Background**

### **A. Increasing Usage of Wireless Expands the Need for Enhanced 9-1-1**

The first cellular system in the country was turned on in 1983. Today, there are over 46 million wireless subscribers (approximately 96% using cellular AMPS-based telephones) -- representing almost 20% of the U.S. population. With so many persons carrying wireless telephones, emergency calls from wireless devices to 9-1-1 have dramatically increased. In 1994, the number of wireless calls per day to 9-1-1 totaled 50,000 nationwide. Last year, the growth of daily emergency wireless calls had reached an estimated 60,000 nationwide. By the turn of the century, this number is expected to top 130,000 calls per day (approaching the number of 9-1-1 calls initiated from wireline networks). Wireless telephones are increasingly used as essential tools in the effort to ensure the broader community's safety, not just for individuals concerned about being able to communicate in emergencies. For example, local crime watch groups across the country, such as Communities on Phone Patrol (COPP) or those in Camden County, use wireless phones to dial 9-1-1 to report incidents and request assistance from local police and rescue units.

As more telecommunications carriers enter New Jersey markets to provide new types of wireless services, lower prices and more competition will mean more usage of wireless phones and, subsequently, more wireless calls to 9-1-1. Wireless 9-1-1 calls represented 43% of all calls to 9-1-1 received at the test area PSAPs during the trial. Across the state, wireless represents a growing proportion of all emergency calls as well.

The growth in wireless use has made a significant contribution to public safety, providing notice of accidents, crimes, and other emergencies more quickly than if only wireline telephones could be used. But because of this increase in wireless 9-1-1 calls, PSAPs throughout New Jersey report an increasing number of challenges that impede their ability to assist people in emergencies. The benefits of E-9-1-1 is lost when PSAPs cannot find these callers.

Wireless calls to E9-1-1 PSAPs have created a new challenge for these operations, both in volume and in the time it takes emergency personnel to respond. Unlike landline calls to E9-1-1, there is no information, such as a callback number or the caller's location, available for wireless calls to E9-1-1 operators. Frequently, wireless callers do not know their exact location, especially at night when surroundings are unfamiliar and the trauma of an accident or other emergency reduces cognizance. Therefore, dispatchers must typically stay on the call longer, attempting to determine the location. When the location cannot be determined, multiple response units must be dispatched to find the caller. It is also common for four to five motorists to call '9-1-1' to report a single accident, all attempting to describe the same location. If the location descriptions are not consistent, dispatchers cannot discern whether there is really just one accident or multiple accidents and may have to play it safe by dispatching multiple units.

Across the country, there have been well publicized incidents in which prompt identification and location of a wireless E9-1-1 caller would have greatly improved response time and increased the chances for reducing injury and saving lives. For example, during a South Dakota blizzard in January, 1997 Karen Nelson of Webster, SD was trapped in her car beneath a snow drift in sub-zero degree temperatures. Her cellular phone saved her life, but it took police and rescue teams over 40 hours to locate her because there was no location technology in place. While some have been more publicized than others, these incidents which happen every week, can be reduced through deployment of wireless location technology.

The typical time a dispatcher spends confirming the location of an enhanced 9-1-1 wireline call is 5-10 seconds. With these calls, the address and call-back number of the calling party is displayed directly in front of the dispatcher, who merely has to confirm the information on wireless calls. Without the new location technology, PSAP dispatchers regularly spend from 30-45 seconds to several minutes on each wireless call. At night, time spent on calls without automatic location technology increases dramatically. One PSAP director in the trial area said, "without location technology, the dispatcher would have to spend time trying to pull-out landmarks from the caller and then in some cases take their best guess."

Without wireless E9-1-1 location technology in place, these factors add up to rising costs for PSAPs and ultimately higher taxes for consumers. Increased wireless use will mean increased 9-1-1 calls from wireless phones. Wireless calls take much longer to process, require greater levels of expertise, and result in much more duplication than wireline emergency calls. If this trend continues, there will have to be larger PSAP facilities, additional trunk lines, more switches, and probably twice as many call-takers. And they will still not know the location of wireless callers.

## **B. FCC Ruling**

The wireless industry, the E9-1-1 community, and the Federal Communications Commission (FCC) began joint efforts in mid-1994 to solve the technological and policy hurdles to providing wireless E9-1-1. In June 1996, the FCC issued a Report and Order in Docket 94-102, formalizing the requirements and implementing a schedule for wireless E9-1-1 emergency calling systems. In so doing, the FCC ordered that implementation and deployment of wireless E9-1-1 features and functions be accomplished in two phases:

### **Phase I (to be completed by April 1, 1998)**

Wireless carriers must report the callback number (also known as Automatic Number Identification or ANI) and originating cell site and/or sector of a 9-1-1 call to requesting 9-1-1 PSAPs.

### **Phase II (to be completed by October 1, 2001)**

Wireless carriers must report the location of all 9-1-1 callers (known as Automatic Location Identification or ALI) with an accuracy of 125 meters (410 feet) for 67% of the callers to requesting 9-1-1 PSAPs.

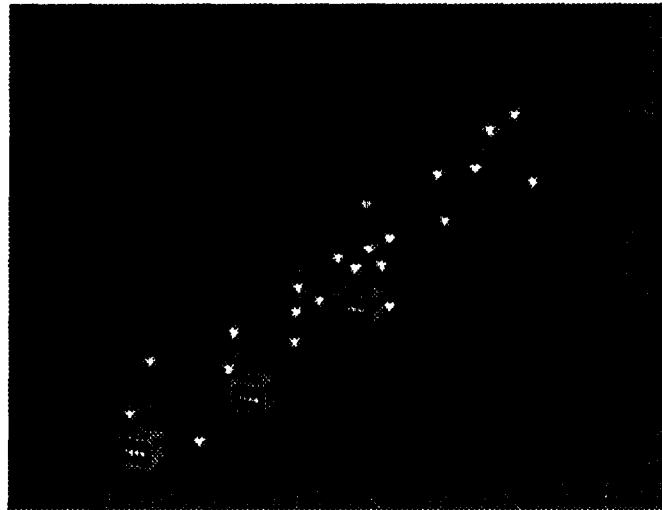
## **II. Background of Trial**

### **A. New Jersey's First in the Nation Live Wireless E9-1-1 Field Test**

Realizing the importance and need for wireless E9-1-1, New Jersey became the first state in the nation to conduct a live trial of wireless E9-1-1 with location technology. On January 22, 1997 the first wireless E9-1-1 system trial was launched in New Jersey using the Comcast Cellular Communications System and the TruePosition Wireless Location System. The Attorney General of the State of New Jersey, the Chairman of the Federal Communications Commission, and the President of the Cellular Telecommunications Industry Association assisted in the launch. The test included a variety of active test participants, including the New Jersey Attorney General's Office, New Jersey State Police, OETS, and E9-1-1 coordinators from Camden, Gloucester and Salem Counties. The key role of Selective Routing (SR) was provided by Bell Atlantic, Rockwell, and SCC. KML, On-Target Mapping, MapInfo, and QED were responsible for the PSAP terminals and the mapping displays.

Prior to the New Jersey trial, no location system had ever been deployed for wireless telephones over such a large area. The TruePosition Time Difference Of Arrival (TDOA) location system OETS tested had previously been successfully tested in smaller areas of 20 square miles or less, including downtown Philadelphia, Baltimore, and Houston. But additional techniques and functionality were to be attempted to scale the location system from 20 square miles to 350 square miles.

The system was tested from January 22 to April 30, 1997 and located wireless E9-1-1 callers on the southern 50 miles of the New Jersey Turnpike/Interstate 295 corridor, an area of approximately 350 square miles. The TruePosition Wireless Location System was deployed on 24 cellular towers of the Comcast Cellular Communications System and covered portions of four counties: Salem County at the southern end, then Gloucester County, Camden County, and Burlington County on the northern end. The location system as deployed is shown in the picture below:



*Figure 1 – Location System Coverage – Receiver and PSAP Coverage*

### Trial Objectives

The objectives of the New Jersey Wireless Enhanced 9-1-1 System trial were to:

- o Implement the first operational wide-area commercial location trial using technology from many participants as a first step in reaching Phase II of the FCC's Report and Order.
- o Accurately measure the performance of a TDOA wireless location system and determine its ability to locate wireless E9-1-1 callers, including the number of receivers required.
- o Based on actual field use, identify any system improvements needed before planning for full state-wide operational systems.
- o Determine the technical system integration required between the many participants in the trial.
- o Determine the impact that a wireless enhanced 9-1-1 system would have on the existing 9-1-1 communications network.

- o Determine the impact of the wireless E9-1-1 system on PSAP operations.
- o Collect anecdotal and statistical evidence useful in determining the value of wireless E9-1-1 systems to callers in actual emergencies.

#### B. Trial Participants

There was a broad range of support and cooperation between private industry and State of New Jersey public agencies. Listed below are the participants of the trial:

##### Government Agencies

Department of Law and Public Safety

Division of State Police

Office of Emergency Telecommunications Services (OETS)

Camden County Department of Public Safety

Gloucester County Department of Public Safety

Salem County Department of Public Safety

##### Companies

The Associated Group/TruePosition, Inc.

Comcast Cellular Communications

Bell Atlantic - New Jersey

SCC Communications

Rockwell Telecommunications

KML Technologies

MapInfo

On-Target Mapping

QED

##### Product and/or Service Provided

TruePosition Wireless Location System

Cellular Network

9-1-1 network communications

9-1-1 selective routing

9-1-1 tandem switch

PSAP terminals

Electronic mapping programs

Electronic map data

Electronic map data

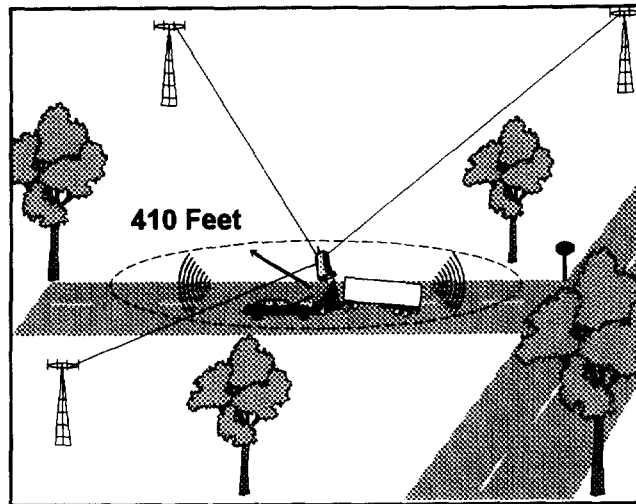
### III. Technology -- How it Works

#### A. Location Technology - TruePosition System

There are over 25,000 cell sites in the U.S. today, but wireless communications networks are designed so that a mobile telephone uses only one cell site at a time. These systems are very efficient for placing calls, but current receivers are not capable of determining an emergency caller's exact location.

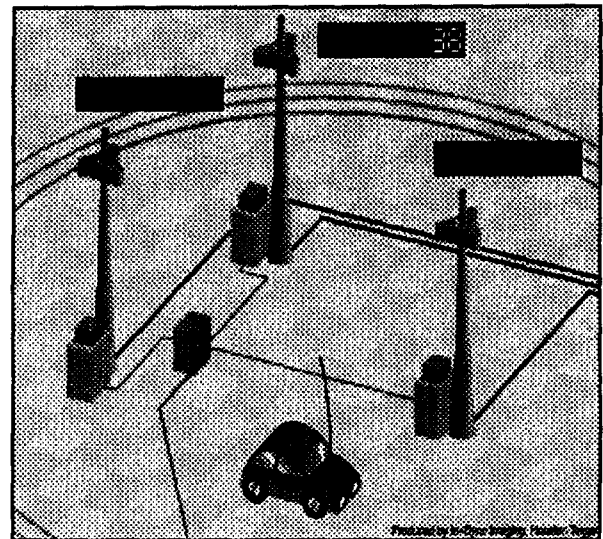
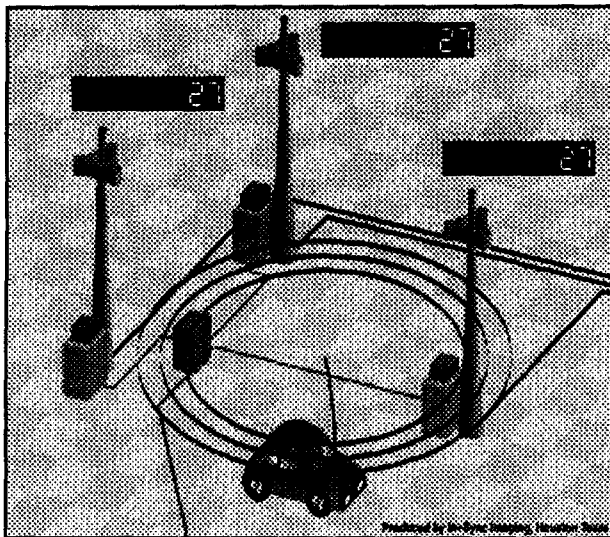
The TruePosition Wireless Location System relies on advanced location receivers added to existing cell sites. The signals transmitted by a cellular phone during a 9-1-1 call are collected by the TruePosition receivers at three to eight different cell sites. The TDOA technology used by TruePosition is the same technology used in the Global Positioning System (GPS) and in many radar systems. TDOA relies on a precise timing of the signals sent by a mobile phone during the start of a 9-1-1 call. The signals travel at the speed of light in many directions from a telephone. TruePosition measures the difference in times the signals reach different receivers, using techniques accurate to billionths of a second. The data collected by these receivers are then combined in a central processing system to calculate an emergency caller's location. Typically, the location is displayed on an emergency dispatcher's computer map terminal before the call is even answered.





*Figure 2 - Location Technology At Work*

The use of TDOA technology at cell sites means that no wireless telephone will need to be changed, including the 46 million wireless telephones in use today in the U.S. Technology upgrades are needed only at cell sites, and users of wireless networks can keep the mobile telephones they already own and still obtain the benefits of E9-1-1.



*Figure 3 – Model of Time Difference Of Arrival Location System*

#### B. E9-1-1 Call Routing Technology

Enhanced wireline 9-1-1 systems today provide a unique feature called Selective Routing. This feature allows 9-1-1 calls to be delivered to the correct PSAP based upon the location from which the call originated. Call routing for each individual telephone number is pre-determined based on address/location information supplied by the local exchange carrier and the emergency response agencies. Call routing and address/location information is updated to databases that are then available for live 9-1-1 call processing. All initial database

creation and ongoing maintenance is performed administratively in background modes. A significant challenge to implementation of a Phase II wireless E9-1-1 solution is the application of coordinate based location information to the proper routing of a 9-1-1 call.

In a wireless network, it is not possible to pre-determine the source location of a 9-1-1 call because the communication devices are always moving. For this reason, the traditional Master Street Address Guide (MSAG) and pre-processed relational files cannot be used. A geofile or map base must become the backdrop for routing decisions. As a coordinate pair is received from the location system, it is electronically plotted against the geofile to determine its relationship to PSAP boundaries. Routing instructions are dynamically created in real time and provided to the E9-1-1 network during the call set up process. The coordinate data is then used dynamically to create an ALI record for distribution to the appropriate 9-1-1 call taker.

Selective Routing technology for the New Jersey Wireless Enhanced 9-1-1 System trial was jointly provided by Bell Atlantic, Rockwell Telecommunications, and SCC Communications Corporation.

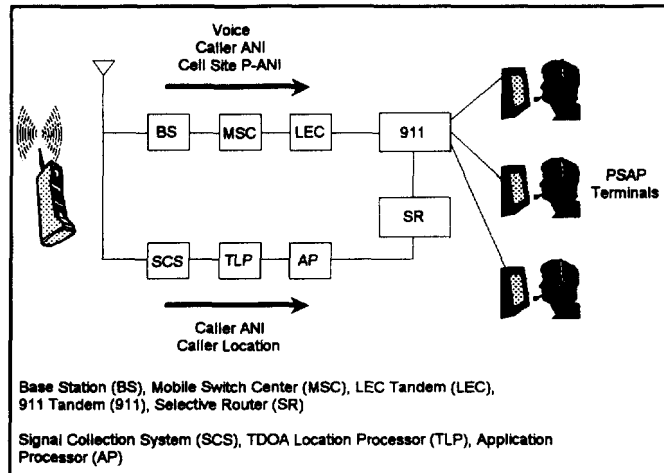
SCC provided their SR/ALI platform, with their Dynamic Call Routing (DCR) feature. The DCR application uses a "Point in Polygon (PiP)" routine for dynamically calculating the Emergency Service Number (ESN), which is used to provide routing instructions to the Rockwell E9-1-1 tandem switch. The creation of a dynamic ESN is the result of matching the X,Y coordinate location of a calling party with an ESN polygon layer in the PiP routine of the DCR application. This information is then provided to the SR/ALI platform where network call routing instructions and ALI records are dynamically created.

Bell Atlantic's E9-1-1 tandem switch, supplied by Rockwell, has the advanced capability of querying an external system for routing instructions. Using this real time interface, the Rockwell SCX queries the SR/ALI system for 9-1-1 call routing instructions and receives the ESN information that was dynamically created using the wireless caller's location data.

This process allows wireless 9-1-1 calls to be delivered to the correct PSAP with location information to support an appropriate emergency response.

#### C. An Integrated Wireless Enhanced 9-1-1 System Design

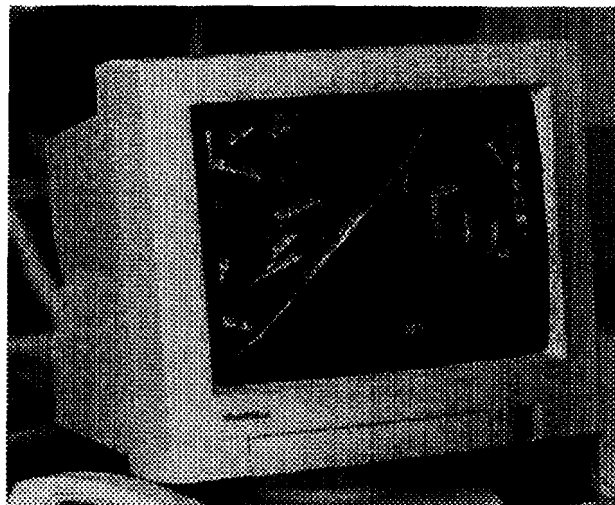
When a person makes a wireless emergency call, information is simultaneously sent through two routes to complete both phases of an E9-1-1 call. The caller's voice, 10-digit wireless phone number (Automatic Number Identification) and information about the nearest cell site (Pseudo-Automatic Number Identification) initiating the call are routed through Comcast Cellular's base station (BS in the following diagram) and Mobile Switch Center (MSC). This information is then passed by Comcast to the Local Exchange Carrier (LEC), which in this case is Bell Atlantic-New Jersey. Bell Atlantic routes the information to the Rockwell 9-1-1 tandem (9-1-1 in the diagram).



*Figure 4 – Wireless Enhanced 9-1-1 System Network Design*

The 9-1-1 tandem then queries the SCC SR/ALI for the proper PSAP to contact, based on location information developed as follows.

At the same time as the above call process is proceeding, the call is also processed through TruePosition's Signal Collection System (SCS) receivers on multiple Comcast cell sites. Each of the SCS's passes timing information to the TDOA Location Processor (TLP), which calculates the caller's location based on the different signal arrival times at the various receivers. TruePosition's Application Processor (AP) then passes on this information to SCC Communications SR/ALI system (SR). The SR/ALI system dynamically determines the correct PSAP destination for the wireless E9-1-1 caller, and then passes the call routing information to Rockwell's 9-1-1 tandem switch. Both sets of information, including the caller's number and the caller's location, are then transmitted to the correct PSAP and displayed on the graphical PSAP terminal (supplied by KML Technologies).



*Figure 5 – Picture of E9-1-1 PSAP Terminal Showing Map*

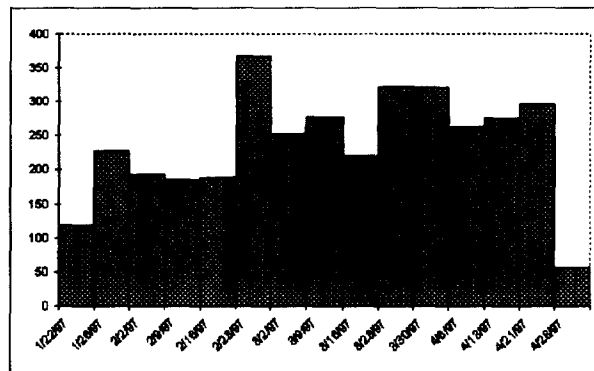
The KML PSAP terminal provides each dispatcher with a toggle switch key to display the text version of a caller's information (phone number and location) and/or graphical mapping information with the caller's location prominently displayed. MapInfo provided electronic mapping programs for the trial and On-Target Mapping and QED provided electronic map data.

#### IV. Trial Results

##### A. Emergency Calls to PSAPs

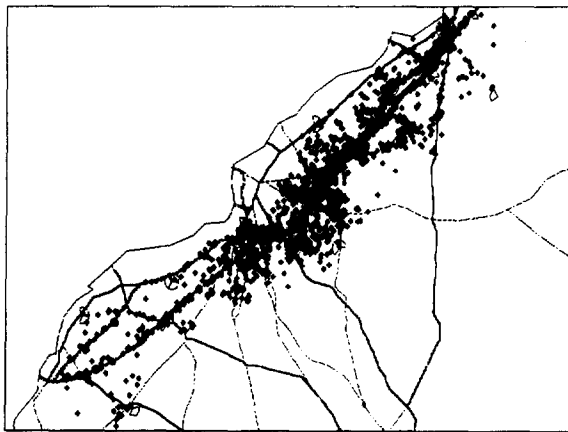
###### 1. Total Calls Located

The TruePosition location system provided location reports for 3,505 actual wireless E9-1-1 callers from January 22 to April 30, 1997. This includes both local customers and visitors traveling from another area. Over the entire period, an average of 35 wireless E9-1-1 callers per day were located, but the actual number of calls per day and per week varied based upon weather and other factors. On the bar graph below, the number of wireless E9-1-1 callers located during each week of the trial is shown along the vertical axis, and the data on the horizontal axis represents a 7-day period beginning on the date shown, except for the first and last weeks, which were shorter in length.



*Figure 6 – Number of Located Wireless 9-1-1 Calls per Week*

A plot of all wireless E9-1-1 callers located by the location system is shown below:



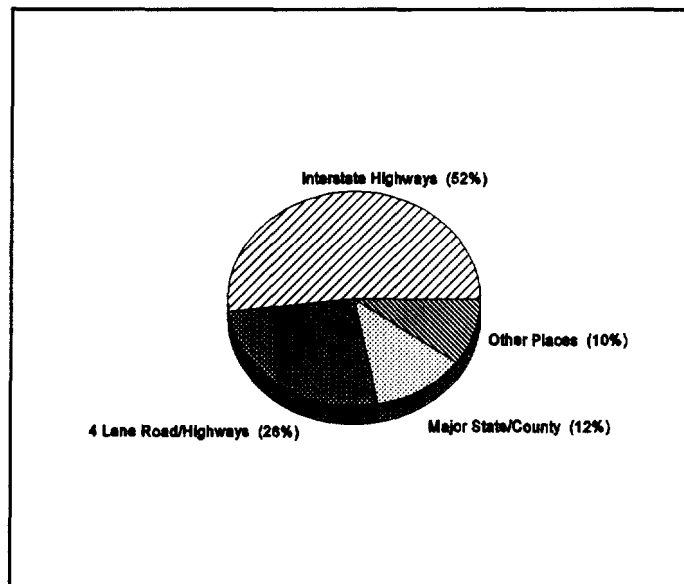
*Figure 7 – Plot of All Wireless 9-1-1 Calls Located by TruePosition*

Each diamond on the diagram represents a single location estimate for a single 9-1-1 call from a subscriber using the Comcast Cellular network. Because there were so many location estimates performed by the system, some of the map appears completely filled. Therefore, the following statistics are useful to understanding the profiles of these wireless E9-1-1 callers.

## 2. Specific Locations of Callers

The locations of the wireless E9-1-1 callers were analyzed to determine where emergencies occur. The 3,505 wireless E9-1-1 calls were grouped into four categories:

- 1,833 (52%) of emergency calls came from interstate highways, such as the New Jersey Turnpike, the Pennsylvania Turnpike Extension into NJ, and I-295.
- 896 (26%) of emergency calls came from other 4 lane roads and highways that did not have interstate designation, such as Routes 42, 55, 70, 73, 38, 41, and 30. Anecdotal evidence suggests that some of these 4-lane highways may have represented an even greater percentage of emergencies if the coverage area of the trial system had been extended. For example, the portions Routes 42 and 55 within the coverage area exhibited heavy call volume, and PSAP dispatchers indicated that the same call volume also extends outside of the coverage area.
- 424 (12%) of emergency calls came from major state and county 2 lane roads, such as Springdale Road, Greentree Road, Evesham Road, Route 541, and many others. These are connector roads typically used for commuting and for access to the 4 lane highways.
- 352 (10%) of emergency calls came from other places, such as residential streets, parking lots, and near or inside buildings.



*Figure 8 – Specific Location of Wireless 9-1-1 Callers*

### 3. Area Codes of Roaming Callers

The TruePosition system was installed on Comcast Cellular Communications cell sites, and was capable of locating any wireless caller compatible with the Comcast system. Many callers were not local, especially on the New Jersey Turnpike. For example, during one accident that occurred during the trial, five calls were received in rapid succession at the Gloucester County PSAP. Based upon the area codes of the five phones used to make the wireless E9-1-1 calls, none of the callers were from New Jersey, southeastern Pennsylvania, or Delaware. The 3,505 E9-1-1 calls were analyzed to determine the ratio of local and non-local callers:

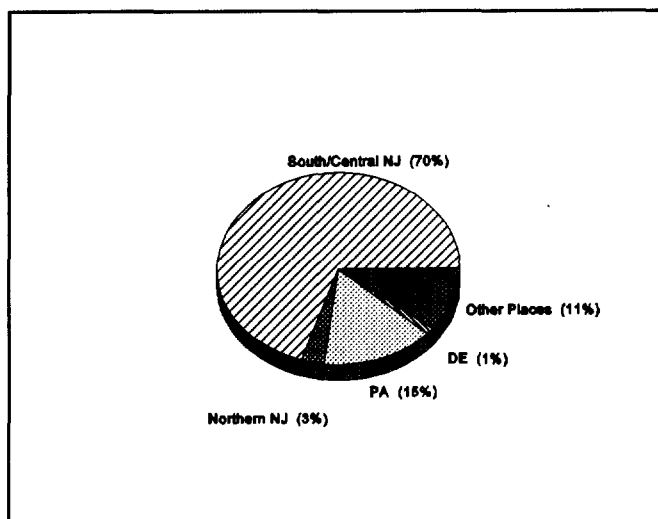
2,464 (70%) of the emergency callers were from southern and central New Jersey (phone numbers beginning with area codes 609 and 908).

103 (3%) of the emergency callers were from northern New Jersey (area code 201).

521 (15%) of the emergency callers were from Pennsylvania (area codes 215 and 610)

44 (1%) of the emergency callers were from Delaware (area code 302).

373 (11%) of the emergency callers were from other area codes.



*Figure 9 – Area Codes of Roaming Callers*

Thus, 30% of the wireless E9-1-1 callers were not local. There was not sufficient anecdotal data collected to determine whether callers from “out of town” were less familiar with their surroundings, and perhaps more likely to require the assistance of location technology to determine their exact location.

In addition to the 3,505 wireless E9-1-1 callers located by the Phase II location system, an additional 1,697 wireless E9-1-1 callers were served by the Phase I (number identification) portion of the trial system. These callers were not within the coverage area of the TruePosition system, and so could not be located. Even though the callers were outside of the location coverage area, the caller’s callback information (ANI) and the cell site could be determined from the Phase I ANI/pseudo-ANI reporting from the cell sites involved in the trial area.

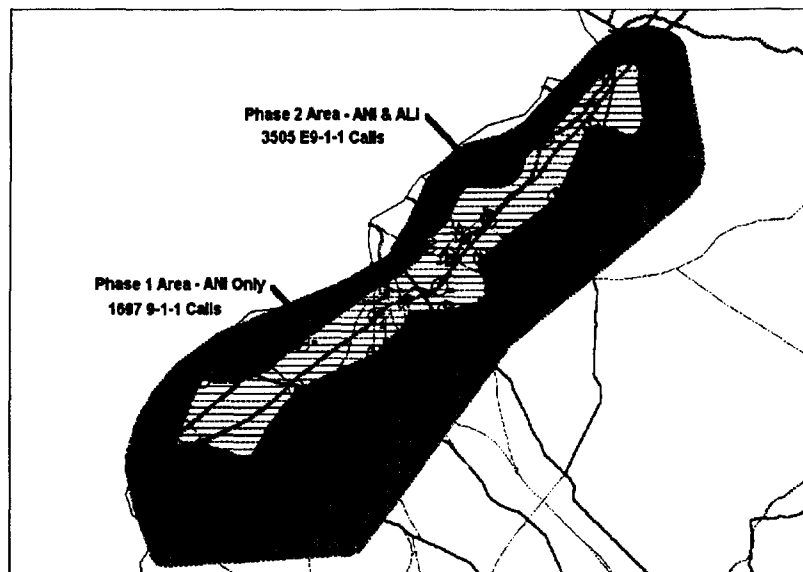


Figure 10 - Phase I/Phase II Area

The trial system was configured so that wireless E9-1-1 callers that were located in the Phase II coverage area of the system were routed to the appropriate PSAP based upon the 9-1-1 caller's calculated location. In all 3,505 cases, the call was routed to the correct PSAP. In contrast, wireless E9-1-1 callers served by the Phase I portion of the trial system were routed to the PSAP closest to the cell site at which the 9-1-1 call originated. These callers were routed to an inappropriate PSAP approximately 30% of the time. This occurred because cell site radio coverage frequently overlaps the geographic boundaries of multiple PSAPs. Additionally, wireless calls do not always connect to the closest cell site, especially if the closest cell site is busy handling other calls. Thus, the PSAP closest to the cell site may not be the cell site closest to the caller.

#### B. Operational Impact on PSAPs

PSAPs today face many challenges in processing wireless E9-1-1 calls. Most wireless users do not realize that emergency personnel have very little, if any, information about their location. The dispatcher on the other end needs to obtain information and communicate calmly to the caller that their call is being processed as quickly and efficiently as possible. One PSAP administrator in the trial area summarized this best by saying: "When you dial 9-1-1 you expect the other person on the phone to know where you are. We have to have the ability to quickly locate the caller and route them to the appropriate PSAP."

Over the course of the trial, OETS met regularly with PSAPs and interviewed E9-1-1 directors and public safety telecommunicators about the wireless location system and its impact on their ability to respond to calls. County 9-1-1 directors reported frequently to OETS about specific situations where the use of the technology further facilitated their operations. The reaction was extremely positive, with the consensus from the PSAPs that the wireless location system greatly improved their ability to respond to emergencies in a timely, efficient manner. As one dispatcher said: "This system takes the *search* out of search and rescue." There were several areas in which the trial demonstrated the positive effects of using the technology:

##### 1. Location Accuracy

Public safety telecommunicators reported that the location technology accurately reported locations of wireless callers during the full period of the trial. In no case did a response unit report being dispatched to an incorrect location.

## 2. Routine Nature of Location System

In interviews with PSAP directors and public safety telecommunicators, it was evident that this technology became a routine part of handling 9-1-1 calls. Rather than an occasional high-profile event, life-saving assists occurred every day. Harrowing, drawn out searches like the famous South Dakota example were avoided because locations were immediately provided, and response times were reduced.

For example, in one incident, a 69 year old woman from out-of-state was visiting relatives late one night. She lost complete power in her car because of a broken alternator. Unable to get out of the car because of recessed power locks, she dialed 9-1-1 to summon help. Because it was late at night and she was stuck in a rural area, she was unable to identify any landmarks and she misidentified her exact location. The dispatcher was able to determine an accurate location because of the TruePosition location system, and a State Trooper was dispatched to the scene and relatives were called to help. The situation was fully resolved in less than 15 minutes.

In another incident during the test period, a wireless E9-1-1 call was received reporting a motor vehicle accident on "Jacksonville Road". The caller could not tell the dispatcher which of four possible Jacksonville Roads in the general area was the right one. The dispatcher was able to see the exact location on the PSAP terminal and send an emergency unit to the scene.

Stories like these became routine occurrences during the system trial. PSAP directors also explained that while adjacent areas were forced to deal with threatening phone calls and bomb threats, no such incidents were reported in the trial area during the test from wireless calls.

## 3. Efficiency of PSAPs

The public safety telecommunicators reported that the time of response to a wireless calls was significantly reduced. Previously, public safety telecommunicators responding to a wireless caller would need to spend several minutes asking questions about the area in order to determine where the call was coming from and attempt to narrow down the location before sending units to respond. During the trial, public safety telecommunicators were able to access the mapping section and find the caller within seconds. For example, the Camden County Coordinator stated: "It is quite evident that because of the triangulation of this cellular 9-1-1 call, the investigation time was greatly reduced. Without it, who knows how long it would have taken to find this MVA [motor vehicle accident]." PSAPs estimate that using the technology, they were typically able to respond and process the average wireless E9-1-1 call under a minute.

Public safety telecommunicators reported that the system helped them manage incoming calls to the PSAPs and coordinate better with informed outgoing requests for assistance to emergency response units. Throughout the State, administrators and public safety telecommunicators often report being overwhelmed with wireless calls, but impeded in their ability to dispatch help properly. The opposite reaction was had by users of this new wireless location system. A participant said: "The new system has not been a problem for the dispatcher. What it has done is raise the comfort level of everyone." Another stated: "The trial made our 9-1-1 center much more efficient, increased the individual capacity of each telecommunicator, and allowed us to serve greater numbers of callers with the same resources."

Public safety telecommunicators also reported that the system assisted them in weeding out duplicative calls from the same location to report traffic accidents, disabled vehicles, etc. Prior to the trial, public safety telecommunicators were often frustrated because they would receive multiple calls with various location descriptions from the wireless callers. Because they did not have the location of the call, they needed to answer



and process each one of them. Because they could not be sure where the emergency was located, they often dispatched multiple units to respond to multiple locations. However, a PSAP official who participated in the trial said: "This technology is helping the well being of every dispatcher. With it they know where the call is coming from so that multiple calls can be removed from the system quickly and appropriate help can be directed to the emergency. Without the technology, we have to figure out if callers are referring to the same accident. People will call with, 'I just passed an accident on Route 55, but don't have any exact location'."

Although the increase in usage of wireless telephones means an increase of E9-1-1 calls for PSAPs, the ability to determine caller's locations in very short periods of time saves PSAPs time and allocates the use of public safety telecommunicators and emergency resources in a more efficient manner. Without wireless location technology, the burden on PSAPs will continue to increase with no means of effectively managing and handling it. One County Coordinator stated: "The percentage of calls from wireless users is now approaching 50%, and has increased steadily even over the last year. With our resources, if we don't implement a system like this, I don't see how we'll be able to respond quickly enough to the calls."

The trial also highlighted the challenges and impact of E9-1-1 in a non-urban setting. A dispatcher said: "In rural areas there are not a lot of road signs and in some areas the nearest intersection may be 2-3 miles away. You can walk blocks and still have no idea where you are." The incident where the woman was stuck in her car at night on a country road is a perfect example. Wireless E9-1-1 may have its greatest impact for PSAPs to locate callers not helped by the seeing the nearest exit sign on an interstate or closest mile marker on a highway. Trial participants also report additional uses for a wireless location system. "When this technology is fully operational it will also have a big impact on boaters on the Delaware River and the Delaware Bay. When a boater breaks down, they have a great deal of difficulty figuring out where they are. When you have a mix between commercial vessels and recreational boaters on the water, it's important to find distressed boaters."

#### 4. Integrating Location Technology System

The PSAPs involved in the trial reported no difficulties in using the new system and indicated that there was little or no transition time once the trial commenced in January. The new system was easy to use and user friendly. The same PSAP terminals and mapping computers for wireline E9-1-1 calls were used for wireless E9-1-1 calls. One dispatcher said, "Everything I needed to know was right there on the screen in front of me within seconds - the caller's number and a map showing the caller's location. Instead of spending time asking a lot of questions, I was able to assure the caller I knew where he was and that a unit was on its way to help him."

During the trial, system integration posed little problems for operators and far outweighed the resources needed to use the system. Some of this success is due to the fact that New Jersey has a coordinated statewide 9-1-1 network, which many states do not. However, the overall success of the trial was only made possible with the total dedication of all of the participants.

#### C. Operational Impact on New Jersey's Existing Wireline 9-1-1 Network

Aside from the usual short term errors encountered in any first time trial, the other components of the trial functioned very well. For example, when OETS first approached Bell Atlantic-New Jersey about participating in the project, the idea was greeted with mixed reactions: "Being out front is both challenging and rewarding, as long as you are successful. We were, after all, talking about running an experimental process through a wireline network that was handling over thirteen thousand live 9-1-1 calls every day." As the scope of the trial became apparent, questions were raised - most of which showed concern:

- o What effect would this trial have on the rest of the network?